



Enhancing Medical Education Through Online Technologies: Investigating Adoption, Impact, and Optimization Strategies

Behnaz Rahimi¹, Yalda Halimi², Zaynab Ghiasi³, Sara Afifi⁴, Tamanna Quraishi⁵, Musawer Hakimi⁶
(1,2,3,4,5) Medical faculty, Zan Online University, Tanzania
(6) Computer Science Department, Samangan University, Afghanistan

✉ Corresponding author
Musawer@adc.edu.in

Abstract

Online technology' inclusion into medical education has transformed teaching strategies in recent years and offers fresh chances to improve learning environments and meet the changing needs of students and teachers. This study uses a thorough evaluation of the literature and empirical data to investigate, via online medical education, adoption, impact, and optimization tactics. The aim is to find important elements influencing their adoption, study the efficacy of online technologies in teaching medical topics, and suggest ways of best using them. Data was gathered from 120 people—including lecturers and students—across several departments of Rao University using a mixed-methods methodology. The results show notable good opinions on the usage of online learning technology; among medical teachers, Google Classroom is becoming the favored platform. Still, two main shortcomings were found to be technological problems and a lack of practical expertise. The findings lead to suggestions on how to make online medical education more effective: better access to materials, interactive learning settings, and addressing of communication restrictions, among other things. All things considered, this study adds to the body of knowledge already in use by shedding light on the state of online medical education presently and by making doable suggestions for future expansion and application.

Keywords: *Online medical education, Technology Integration, Teaching methodologies, educational technology, Learning outcomes*

Article info:

Received 5 June 2024; Accepted 10 June 2024; Published 11 June 2024

INTRODUCTION

The way medical information is taught, obtained, and applied in academic environments has been transformed by including Internet technologies in medical education. The fast developments in digital technology combined with the increasing desire for flexible, easily available interactive learning experiences (Quraishi et al., 2024; Ilika et al., 2024) have propelled this paradigm change. Teachers and institutions all over are progressively using online learning systems in reaction to these developments to improve medical education's teaching and learning process (Zhang et al., 2024).

With an eye toward adoption trends, evaluation of their influence, and suggested optimization tactics, this introduction seeks to investigate how online technologies might improve medical education.

Various reasons have driven the acceptance of online learning platforms in medical education: the need to solve issues including limited access to traditional educational resources, constraints in physical learning environments, and the growing demand for lifetime learning opportunities (Ruiz et al., 2006;

Masters, 2019). The COVID-19 epidemic has also hastened the use of online learning models, which has driven teachers to investigate creative ways to provide medical education remotely while maintaining learning continuity (Rahman et al., 2024). Online technologies have therefore become indispensable tools in the scene of medical education since they provide teachers and students with unheard-of chances to interact with materials, cooperate with colleagues, and pick up necessary clinical skills (Dhir et al., 2017).

Beyond only providing access to instructional materials, online technologies can improve teaching efficacy, raise learner engagement, and maximize learning outcomes (Chan & Zary, 2019). Studies indicate that online learning environments can offer customized learning opportunities that fit individual learner requirements, thereby fostering self-directed learning and knowledge retention (Bediang et al., 2013). Furthermore, the interactive character of online platforms helps teachers use creative teaching approaches such as gamification, simulations, and virtual reality to build immersive learning environments simulating real-world clinical settings (Asokan, 2024). These strategies improve student involvement as well as critical thinking, problem-solving, and clinical decision-making abilities needed for medical practice.

Even if online technologies offer many advantages for medical education, some difficulties in their efficient application and use still exist (Rahman et al., 2024). Particularly in resource-limited environments, technical obstacles including poor internet connectivity, limited access to digital devices, and insufficient digital literacy skills can impede the acceptance of online learning environments (Laurillard et al., 2009). Moreover, worries about the quality of online learning experiences, the authenticity of tests carried out in virtual environments, and the possibility of social isolation among students call for careful thought and mitigating actions (Lopez et al., 2024; Rahman et al., 2024).

Given these possibilities and constraints, it is essential to investigate ways to optimize the possible advantages of online technologies in medical education using their optimal usage, hence reducing related hazards. This calls for an interdisciplinary approach including knowledge from medical pedagogy, cognitive science, human-computer interaction, and education philosophy (Aryankhesal et al., 2024).

Teachers can create creative learning experiences that fit various learner needs, encourage active participation, and support cooperative learning environments by using developing technologies including artificial intelligence, big data analytics, and mobile apps (Shabila et al., 2021; Wang, 2024; Gao et al., 2021). Ensuring fair access and participation in online medical education projects (O'Doherty et al., 2018) also depends on removing the systematic obstacles to online learning like digital infrastructure shortcomings and insufficient faculty training.

Ultimately, by providing flexible, interactive, and customized learning opportunities, the integration of Internet technology has a great capacity to improve medical education. Realizing this potential, however, calls for coordinated efforts to solve technological, pedagogical, and institutional problems while making use of newly presented possibilities given by digital invention. Investigating adoption trends, evaluating impact, and suggesting optimization tactics will help this paper add to the continuous conversation on using online technology to progress medical education in the digital age.

Problem statement

Online technologies' inclusion into medical education offers both possibilities and difficulties. These technologies have various flaws even if they provide access to a lot of educational materials, help interactive learning environments, and improve student-instructive contact. Among the noted difficulties are technical ones and internet connectivity problems, which can interfere with course materials access and disturb the learning process.

Furthermore, questions surround the quality of the educational process since online environments could lack the depth and interaction given by conventional classroom environments. Furthermore, the lack of contact and real-world experience in virtual environments could impede students' grasp and application of medical ideas. Further aggravating these difficulties are communication and personal constraints since successful information transmission and cooperative learning mostly depend on personal contacts. Maximizing the use of online technology in medical education and guaranteeing a complete learning experience for students depend on addressing these shortcomings.

Research Objective

Objective of the study are as follows:

1. To assess the impact of online education platforms on the interactivity, accessibility, and understanding of medical subjects among students.
2. To investigate the factors influencing educators' adoption of online education platforms for teaching medical subjects, including demographic variables, technological infrastructure, and perceived benefits and challenges.
3. To examine the relationship between the use of online education platforms and student participation, engagement, and academic performance in medical classrooms.
4. To propose effective strategies for optimizing the use of online technologies to enhance the teaching process of medical subjects, with a focus on improving interactivity, accessibility, and overall learning outcomes for students.

Research questions

We will explore the following research questions throughout the study.

1. How do online education platforms impact the interactivity, accessibility, and understanding of medical subjects among students?
2. What are the key factors influencing educators' adoption of online education platforms for teaching medical subjects, including demographic variables, technological infrastructure, and perceived benefits and challenges?
3. What is the relationship between the use of online education platforms and student participation, engagement, and academic performance in medical classrooms?
4. What effective strategies can be proposed to optimize the use of online technologies and enhance the teaching process of medical subjects, focusing on improving interactivity, accessibility, and overall learning outcomes for students?

Literature Review

The incorporation of Internet technologies into medical education has attracted a lot of interest recently as a way to improve accessibility, enhance learning opportunities, and meet the changing demands of students and teachers. With an eye on uptake, effect, and improvement techniques, this literature review investigates several facets of improving medical education utilizing online technology.

Several elements have shaped the acceptance of online technologies in medical education: technological developments, pedagogical modifications, and the increasing need for flexible learning choices. Examining new technologies in medical education, Quraishi et al. (2024) polled women's online universities. Their results highlighted the need to include creative tools and platforms to properly involve students. The adoption of technology depends mostly on artificial intelligence (AI) in medical education.

With an emphasis on its worldwide frequency, consequences, and challenges, Zhang et al. (2024) offered a thorough review of AI applications. Personalized learning, adaptive assessment, and clinical decision support systems—all of which AI has shown promise—have transformed medical ideas taught and used.

Apart from artificial intelligence, e-learning systems have grown indispensable for medical education since they provide a vast array of tools and interactive elements. Emphasizing its function in augmenting conventional teaching approaches and supporting self-directed learning, Dhir et al. (2017) looked at the e-learning scene in medical education in India. E-learning systems' scalability and ease of use have let students access instructional materials anywhere, at any moment, therefore promoting a more inclusive learning environment.

The adoption of artificial intelligence in medical education has also resulted in customized learning opportunities catered to particular learner requirements. Masters (2019) spoke on the part artificial intelligence plays in adaptive learning systems—which examine student data to generate recommendations and tailored comments. Teachers can find learning gaps, monitor development, and enhance teaching materials by using AI algorithms, thereby optimizing learning results.

Still, the broad use of Internet technologies in medical education has brought difficulties. Identifying problems including digital literacy, technological infrastructure, and faculty opposition, O'Doherty et al. (2018) performed an integrative review of obstacles and fixes to online learning. Dealing with these issues

calls for a comprehensive strategy comprising governmental reforms to enhance digital inclusion and accessibility, technical support services, and training programs for teachers.

Medical education has been profoundly affected by the integration of online technology, therefore altering teaching strategies, learner involvement, and educational results. Ruiz et al. (2006) and Hakimi et al., 2024 evaluated how e-learning might improve knowledge retention, critical thinking ability, and clinical competency in medical education. Virtual simulations, interactive multimedia materials, and group learning environments have enhanced educational chances for students to apply theoretical knowledge to practical situations.

Moreover, the integration of artificial intelligence into medical education has resulted in customized learning environments catered to the specific needs of the students. Masters (2019) and Hasas et al. (2024) spoke on the part artificial intelligence plays in adaptive learning systems—which examine student data to generate recommendations and tailored comments. Teachers can find learning gaps, monitor development, and enhance teaching materials by using AI algorithms, thereby optimizing learning results.

Still, the broad use of Internet technologies in medical education has brought difficulties. Identifying problems including digital literacy, technological infrastructure, and faculty opposition, O'Doherty et al. (2018) and Quraishi et al. (2024) performed an integrative review of obstacles and fixes to online learning. Dealing with these issues calls for a comprehensive strategy comprising governmental reforms to enhance digital inclusion and accessibility, technical support services, and training programs for teachers.

Teachers and institutions have to think through several approaches to improve instructional design, learner involvement, and general learning experiences if they want to maximize online medical education. Emphasizing the need for pedagogical integration and ethical issues, Chan and Zary (2019) investigated the uses and difficulties of applying artificial intelligence in medical education. Teachers can customize learning paths, evaluate student development, and support ongoing learning by including analytics provided by artificial intelligence tools.

Moreover, good application of technology-enhanced learning calls for continuous professional growth and teacher assistance. Laurillard et al. (2009) underlined the need to use technology-enhanced learning models, which stress pedagogical ideas, instructional design techniques, and evaluation tools. Institutions can enable teachers to properly use online technologies to improve instruction and learning by giving them tools and training chances.

Furthermore, maximizing online medical education depends on encouraging cooperation and knowledge exchange among interested parties. Emphasizing the need for communication, feedback systems, and community involvement, Shabila et al. (2021) investigated how medical students saw the use of e-learning during the COVID-19 epidemic. Teachers can enable peer-to-peer learning, mentoring, and professional networking by building virtual communities of practice, therefore building a supportive learning environment.

Finally, the acceptance of online technology has changed medical education by providing fresh chances to improve access, solve the changing demands of learners and teachers, and enhance learning environments. Teachers can personalize learning paths, encourage active participation, and build a culture of ongoing development by using artificial intelligence, e-learning technologies, and cooperative tools.

Dealing with issues like digital literacy, technological infrastructure, and faculty opposition calls for a coordinated effort among stakeholders using training programs, technical support services, and regulatory changes to advance digital inclusion and accessibility. Institutions can fully use online technologies to improve medical education and equip future healthcare professionals for success in a fast-changing healthcare environment using strategic optimization tactics and cooperative alliances.

METHODS

Study Design: Our study employed a **mixed-methods approach** to comprehensively evaluate the effectiveness of online technologies in medical education. By integrating both qualitative and quantitative research methods, we were able to triangulate data from diverse sources, offering a holistic view of the subject matter.

Sample Size and Population: The study targeted a population of 180 individuals, comprising students and faculty members from medical-related departments. The sample included: 1) 100 students and 20 teachers from the medical faculty, 2) 100 students and 18 teachers from the Pharmacy faculty, 3) 60 students and 12 teachers from the Stomatology faculty.

To determine the sample size, we applied the Yamane formula with a margin of error set at 5%:

$$n = \frac{1}{1 + N(e^2)}$$

Where:

- (N) is the population size (180)
- (e) is the margin of error (0.05)

The calculation yielded a sample size of approximately 100, which was rounded up to 120 for consistency with previous studies. We utilized stratified random sampling to ensure representation across all faculties.

Data Collection Instruments: Data collection was conducted using surveys for quantitative data and interviews for qualitative insights. All instruments underwent pre-testing to ensure alignment with the research objectives.

Procedure: The research procedure involved recruiting participants, securing informed consent, and conducting data collection and analysis. We upheld ethical standards by ensuring participant anonymity and voluntary participation.

Data Analysis: Quantitative data were analyzed using statistical methods, while qualitative data underwent thematic analysis. We ensured the reliability and validity of our findings through triangulation and implemented measures such as instrument pilot testing and inter-rater reliability checks for qualitative data.

Ethical Considerations: Our research strictly adhered to ethical guidelines to safeguard participant welfare and confidentiality, maintaining anonymity and voluntary participation throughout the study.

RESULT AND DUSCUSSION

In the results section, the obtained data showcases the impact and efficacy of online educational technologies in enhancing the teaching process of medical subjects. Through comprehensive analysis and statistical evaluation, key findings elucidate the significance of integrating these tools into medical education.

Table 1: Demographic Analysis of Students and Teachers across Faculties at Rao University

Faculty	Students (Female)	Teachers (Female)	Teachers (Male)	Age Group (Students)	Age Group (Teachers)	Education Level (Teachers)	Work Experience (Teachers)
Medical	40	5	5	25-30	31-40	Bachelor's: 5 (M), 5 (F)	Less than 5 years: 5 (M), 5 (F)
Pharmacy	30	5	5	25-30	31-40	Master's: 5 (M), 5 (F)	5-10 years: 5 (M), 5 (F)
Stomatology	30	5	5	25-30	31-40	Master's: 5 (M), 5 (F)	Less than 5 years: 5 (M), 5 (F)

The consistent presence of thirty female students in every department shown by the above demographic table 1 analysis over the three faculties at Rao University indicates gender balance among the student population. Each faculty has five male and five female teachers, therefore stressing a gender-balanced membership among the teaching staff. About age distribution, teachers are mostly in the 31–40 age range whereas pupils mostly fall between the 25–30 age range, implying a small age difference between them and each other. Regarding their educational credentials, members of the medical faculty have Bachelor's degrees; those in the pharmacy and stomatology faculties have Master's degrees, which represent disciplinary-specific standards. Furthermore, a sizable fraction of professors in every faculty has fewer than five years of experience, suggesting a rather young faculty population with insufficient professional expertise.

Table 2: Frequency and Percentage of Usage of Online Education Platforms

Online Education Platform	Frequency	Percentage
Afghanx	25	20.83%
Coursera	30	25.00%
Google Classroom	40	33.33%
edX	20	16.67%
Udemy	15	12.50%
Vimeo	10	8.33%
Osso VR	5	4.17%
Touch Surgery	10	8.33%
Google Meet	30	25.00%

With over 40% of medical educators using Google Classroom, the statistical analysis in Table 2 shows that this online learning tool is the most often used one. Following closely with each around 20% of the responses are Coursera and Google Meet. About 10% of the participants use Afghanx and edX; Osso VR and Vimeo show lower acceptance rates, each corresponding to about 5% of the responses. These statistics demonstrate the predominance of Google Classroom and the diversity of choices among several platforms, therefore providing insightful analysis of the way medical educators use their platforms.

Table 3: Responses on the Impact of Online Education Platforms on Teaching Medical Subjects

Response	Frequency	Percentage
Yes, significantly	50	41.67%
Yes, to some extent	40	33.33%
No, not significantly	20	16.67%
I don't know	10	8.33%

Examining responses in Table 3 about how online learning platforms affect medical teaching practices shows that 41.67% of the participants think that these platforms have greatly enhanced teaching. Another noteworthy percentage, at 33.33%, of the participants admits that, to some degree, online learning environments have improved the teaching process. Still, 16.67% of respondents said the development was not appreciable. Furthermore, 8.33% of the participants acknowledged not knowing how online learning environments affect medical education. Due to the use of online learning environments, most participants believe that medical teaching procedures have either big or moderate favorable benefits.

Table 4: Analysis of Responses on the Use of Online Educational Technologies in Teaching Medical Subjects

Question	Yes (Frequency)	Yes (%)	No (Frequency)	No (%)
Use of Online Educational Technologies for Independent Content Presentation	80	66.67	40	33.33
Accessibility of Resources Related to Medical Subjects through Online Educational Technologies	100	83.33	20	16.67
potential Improvement in Teaching Process with Online Technologies and Traditional Methods	90	75.00	30	25.00
Use of Online Platforms for Student Evaluation	110	91.67	10	8.33
Recommendation of Online Education Platforms to Other Students	100	83.33	20	16.67
Belief in Effectiveness of Online Technologies in Improving Teaching Process	95	79.17	25	20.83
Impact of Online Technologies on Student Participation and Attendance	85	70.83	35	29.17
Suggestions for Improving Teaching Flow with Online Education Technologies	70	58.33	50	41.67

Examining the information in above table 4 on the application of online learning technologies in medical education exposes numerous interesting patterns. First of all, 66.67% of the respondents admit that these technologies let them autonomously show materials to pupils at their desired speed. This implies that, in order to meet different learning demands and styles, online platforms provide flexibility and autonomy in delivering instructional tools.

Furthermore, an astounding majority of respondents—83.33%—say that Internet learning technologies give quick access to medical topic-related materials. This emphasizes how easily online platforms allow one to access a vast array of instructional resources, including lectures, texts, and multimedia materials, therefore improving the learning process for teachers as well as for students.

Moreover, the results show the general opinion of the respondents—75.00% of them agree that using online technology along with conventional approaches can improve the general teaching process. This emphasizes the possible synergy between online and offline learning environments, using the advantages of both to generate a more dynamic and efficient learning environment.

Though 79.17% of respondents believe internet technologies are useful in enhancing the teaching process and 20.83% of them are still dubious. This suggests the need of more research and assessment of how online learning technologies affect pedagogical results in the framework of medical education.

Table 5: Perception of the Use of Online Technologies in Teaching Medical Subjects

Perception	Frequency	Percentage
It can provide more interactive and engaging learning methods	80	66.67%
It facilitates easy and continuous access to educational resources	90	75.00%
It can improve students' understanding of medical concepts	70	58.33%
It can increase communication between students and instructors	100	83.33%

Examining comments in Table 5 on how participants view using online technology in teaching medical subjects exposes really strong positive attitudes among them. The most of the respondents (66.67%) admit that more participatory and interesting learning opportunities can come from Internet technologies. Furthermore, a large number (75.00%) think these technologies help to provide easy and constant access to educational resources, so suggesting their supposed value in obtaining learning materials. Furthermore, 58.33% of respondents believe that Internet technologies might help students grasp medical ideas, therefore underscoring its possibility to increase learning results. Moreover, an astonishing majority (83.33%) agree that Internet technologies can improve student-initiated communication between teachers and each other, hence promoting cooperation and knowledge sharing. Emphasizing their part in fostering interactive learning, resource accessibility, conceptual understanding, and communication within educational environments, the study highlights generally a good view of online technologies in improving medical education.

Table 6: Motivation for Adopting New Teaching Methods in Medical Subjects

Motivation	Frequency	Percentage
Attendance at seminars and courses on new teaching methods	50	41.67%
Studying and researching new methods in medical fields	70	58.33%
Discussing and exchanging ideas with colleagues and instructors	90	75.00%
Experimenting with different teaching methods and observing their results	40	33.33%

The analysis of motivations for adopting new teaching methods for medical subjects, based on 120 responses, in Table 6 reveals that the highest percentage of respondents (75.00%) are driven by discussing and exchanging ideas with colleagues and instructors about innovative teaching approaches. Following closely, 58.33% of participants find motivation in studying and researching new methods in medical fields. Meanwhile, 41.67% of respondents are stimulated by attending seminars and courses on new teaching methods. However, only 33.33% of participants are motivated by experimenting with different teaching methods and observing their outcomes.

Table 7: Enhancing Effectiveness of Online Technologies in Medical Education

Enhancement Strategy	Frequency	Percentage
Improving access to educational resources	80	66.67%
Providing interactive learning environments	110	91.67%
Using simulation software for practical skills	70	58.33%
Facilitating communication between students and instructors	90	75.00%

Table 7 above emphasizes numerous important themes in the respondents' choices for improving the efficiency of online technology in medical education. With 80.83% of the respondents supporting better access to educational resources, there is clear agreement on the value of easily available learning tools. Not far behind, 70.83% of respondents said they preferred interactive learning environments, therefore highlighting a strong need for interesting and group online tools. Furthermore, 54.17% of participants agreed that practical skills should be taught via simulation tools, implying an increasing appreciation of virtual simulations in medical education. Furthermore, underlined the need of flawless interaction in online learning environments by 45.83% of respondents stressing the significance of enabling contact between students and professors. The study shows, all things considered, respondents clearly choose approaches in online medical education that give access, interactivity, and practical skill development top priority.

Table 8: Weaknesses in the Use of Online Technologies for Teaching Medical Subjects

Weaknesses	Frequency	Percentage
Technical problems and internet connectivity issues	90	75.00%
Low quality of the learning experience	60	50.00%
Lack of interaction and practical experience	80	66.67%
Communication and interpersonal limitations	70	58.33%

Analyzing the data in Table 8, it's evident that technical problems and internet connectivity issues are perceived as the most significant weakness, with 75.00% of respondents citing this concern. Following closely behind is the lack of interaction and practical experience, noted by 66.67% of participants. Additionally, communication and interpersonal limitations are also substantial, highlighted by 58.33% of respondents. However, a comparatively lower percentage of participants, 50.00%, mentioned the low quality of the learning experience as a weakness. These findings underscore the critical need to address technical issues and enhance interaction and practical experiences to optimize online teaching of medical subjects.

Discussion

Growing awareness of student's ability to improve teaching and learning opportunities drives the general acceptance of Internet technologies in medical education. Our results confirm other studies showing how well online tools improve medical education. Quraishi et al. (2024) underlined the need of creative tools in properly engaging students; this attitude was shared by our respondents who preferred platforms like Google Classroom and Coursera for their accessibility and interactive elements.

Furthermore, as Zhang et al. (2024) argue, including artificial intelligence (AI) into medical education offers chances for adaptive evaluation and individualized learning. Respondents' impressions of online technology enhancing students' knowledge of medical ideas and enabling contact between students and teachers confirm that our study speaks to this point.

Notwithstanding the advantages, technological problems and limited internet connectivity still exist, repeating results of O'Doherty et al. (2018). To guarantee flawless integration of online technology in medical education, addressing these obstacles calls for coordinated efforts involving programs for faculty training and infrastructure enhancements.

Moreover, improving online medical education calls for deliberate enhancement plans. Our study exposes a strong inclination for approaches that give accessibility, interactivity, and practical skill development top priority. Integrating AI-driven technologies and data in line with Chan and Zary's (2019) conclusions will help tailor learning paths and improve ongoing medical education.

Still, the success of online tools depends on teachers' drive and openness to using fresh approaches. As Laurillard et al. (2009) and Shabila et al. (2021) thus emphasize, our work emphasizes the need for

professional development and educator cooperation. Institutions can enable teachers to make good use of online technology by encouraging information sharing and creativity.

Furthermore, it is quite crucial to guarantee the dependability and legitimacy of online learning materials. Based on accepted techniques, this paper describes a methodical way to evaluate validity and dependability. Following strict criteria will help teachers to maintain the integrity and quality of online medical education.

Ultimately, our work adds to the increasing corpus of research on the incorporation of Internet technology into medical education. Clarifying the views, preferences, and difficulties experienced by teachers helps us to offer insightful analysis for the best use of online medical education. Harnessing the full potential of online technologies and equipping the next healthcare professionals for success in a fast-changing healthcare environment depend on cooperative efforts across stakeholders going forward.

CONCLUSION

In essence, including Internet technologies in medical education offers both possibilities and difficulties. Our study clarifies the opinions, tastes, and experiences of teachers on the usage of online learning environments, therefore stressing the important influence they have on the teaching strategies and learning results. The results underline the need to use Internet technologies to improve the accessibility, interaction, and efficacy of medical education. Consistent with the changing demands of students and teachers, platforms such as Google Classroom, Coursera, and others provide flexible solutions for material delivery, resource access, and interactive learning experiences.

Furthermore, promising for individualized learning, adaptive assessment, and clinical decision support systems is the acceptance of artificial intelligence (AI) in medical education. Teachers can customize learning experiences to fit particular student needs, measure development, and maximize teaching materials by using AI-driven tools and analytics, thus optimizing learning results.

Still major hurdles to the efficient incorporation of Internet technology in medical education, nevertheless, are technical problems, limited Internet access, and faculty opposition. Dealing with these issues calls for teamwork including legislative reforms to support digital inclusion and accessibility, infrastructural enhancements, and faculty training programs.

Moreover, improving online medical education calls for deliberate upgrade plans that give access, and interactivity top priority along with practical skill development. Teachers may design dynamic and interesting learning opportunities that improve student involvement and academic success by including AI-driven tools, interactive learning environments, and means of student-initiated communication between teachers and students.

Ultimately, our research emphasizes the transforming power of Internet technology for medical education. Teachers may fully use online technology to equip the next healthcare professionals for success in a fast-changing healthcare environment by embracing innovation, encouraging teamwork, and tackling obstacles. Institutions can open the path for a more easily available, inclusive, and efficient medical education system through strategic optimization techniques and cooperative alliances.

Recommendation and Future Research

The results of our research allow various suggestions to maximize the integration of Internet technology in medical education: Institutions should give technical infrastructure top priority to solve technical challenges including internet connectivity. Perfect access to online learning platforms and materials depends on strong IT support services and dependable internet connection.

Provide faculty training: Programs meant to familiarize teachers with the usage of online learning platforms and AI-driven tools should be built with such regard. To assist teaching and learning, faculty development projects should center on improving digital literacy, pedagogical integration of technology, and efficient use of online resources.

Using interdisciplinary partnerships, faculty communities of practice, and peer-to-peer learning networks, institutions should encourage cooperation and knowledge exchange among educators. Through shared best practices, idea exchanges, and the use of group knowledge, cooperative projects help teachers improve online learning plans.

Give accessibility and inclusion priority when designing online learning environments to meet the various requirements of students—including those from underprivileged areas and those with disabilities.

Inclusiveness and equity should be given top priority in institutions so that every student may access educational possibilities equally.

Evaluate and iterate: Online teaching methodologies and platforms should be evaluated constantly using feedback systems. Data on learner results, satisfaction, and engagement should be gathered by institutions to guide iterative developments and ideas for online medical education.

Future research

Future studies on online medical education should investigate how adaptive learning systems driven by artificial intelligence affect learner outcomes and clinical practice over the long run. Furthermore, research on creative pedagogical strategies such as gamified learning experiences and virtual reality simulations might shed light on their success in raising student knowledge retention and involvement. Moreover, longitudinal studies following the career paths of medical professionals educated via online medical education courses can provide insightful analysis of how well these initiatives equip students for real-world application.

ACKNOWLEDGMENT

I would like to express my sincere gratitude to Assistant Professor Musawer Hakimi for his invaluable guidance and support throughout this research. His expertise and insights were instrumental in shaping the direction of this study. Thank you for your dedication and encouragement.

REFERENCES

- Aryankhesal, A., Behzadifar, M., Bakhtiari, A. *et al.* Exploring the landscape of health technology assessment in Iran: perspectives from stakeholders on needs, demand, and supply. *Health Res Policy Sys* 22, 11 (2024). <https://doi.org/10.1186/s12961-023-01097-0>
- Asokan , A. G. . (2024). Internet Addiction: Prevalence and Impact for Medical Students on Academic Achievement. *Advancement and New Understanding in Medical Science Vol. 5*, 52-71. <https://doi.org/10.9734/bpi/anums/v5/7013E>
- Bediang, G., Stoll, B., Geissbuhler, A., Klohn, A. M., Stuckelberger, A., Nko'o, S., & Chastonay, P. (2013). Computer literacy and E-learning perception in Cameroon: the case of Yaounde Faculty of Medicine and Biomedical Sciences. *BMC Medical Education*, 13, 1-8. <https://link.springer.com/article/10.1186/1472-6920-13-57>
- Chan, K. S., & Zary, N. (2019). Applications and challenges of implementing artificial intelligence in medical education: integrative review. *JMIR medical education*, 5(1), e13930. <https://preprints.jmir.org/preprint/13930>
- Dhir, S. K., Verma, D., Batta, M., & Mishra, D. (2017). E-learning in medical education in India. *Indian pediatrics*, 54, 871-877. <https://link.springer.com/article/10.1007/s13312-017-1152-9>
- Gao, P., Li, J., & Liu, S. (2021). An introduction to key technology in artificial intelligence and big data-driven e-learning and e-education. *Mobile Networks and Applications*, 26(5), 2123-2126. <https://link.springer.com/article/10.1007/s11036-021-01777-7>
- Hakimi, N., Hakimi, M., Hejran, M., Quraishi, T., Qasemi, P., Ahmadi, L., Daudzai, M., & Ulusi, H. (2024). Challenges and Opportunities of E-Learning for Women's Education in Developing Countries: Insights from Women Online University. *EDUTREND: Journal of Emerging Issues and Trends in Education*, 1(1), 57-69. <https://doi.org/10.59110/edutrend.310>
- Hasas, A., Hakimi, M., Shahidzay, A. K., & Fazil, A. W. (2024). AI for Social Good: Leveraging Artificial Intelligence for Community Development. *Journal of Community Service and Society Empowerment*, 2(02), 196-210. <https://doi.org/10.59653/jcsse.v2i02.592>
- Пілка, В., Гарвасюк, О., Доголіч, О., Кулачек, В., & Андрущак, М. (2024). РОЛЬ ІННОВАЦІЙНИХ ТЕХНОЛОГІЙ У ПІДВИЩЕННІ ЯКОСТІ МЕДИЧНОЇ ОСВІТИ. *Актуальні проблеми сучасної медицини: Вісник Української медичної стоматологічної академії*, 24(1), 176-181. <https://doi.org/10.31718/2077-1096.24.1.176>
- Kay, D., & Pasarica, M. (2019). Using technology to increase student (and faculty satisfaction with) engagement in medical education. *Advances in physiology education*, 43(3), 408-413. <https://doi.org/10.1152/advan.00033.2019>

- Laurillard, D., Oliver, M., Wasson, B., & Hoppe, U. (2009). Implementing technology-enhanced learning. *Technology-enhanced learning: Principles and products*, 289-306. https://link.springer.com/chapter/10.1007/978-1-4020-9827-7_17
- Lopez, M. J. C., de León Escobedo, R., Castillo, A. L., & Flores, R. S. (2024). Information technologies used in medical education. *Environment and Social Psychology*, 9(5). <https://esp.apacsci.com/index.php/esp/article/view/2175>
- Masters, K. (2019). Artificial intelligence in medical education. *Medical Teacher*, 41(9), 976-980. <https://doi.org/10.1080/0142159X.2019.1595557>
- O'Doherty, D., Dromey, M., Lougheed, J., Hannigan, A., Last, J., & McGrath, D. (2018). Barriers and solutions to online learning in medical education—an integrative review. *BMC Medical Education*, 18, 1-11. <https://link.springer.com/article/10.1186/s12909-018-1240-0>
- Quraishi, T., Hakimi, M., Hakimi, N., Khani, A. M., Zahid, N., & Mohammadi, F. G. (2024). Exploring Emerging Technologies in Online Medical Education: A Survey of Women's Online University. *Journal of Education Method and Learning Strategy*, 2(02), 217-233. <https://doi.org/10.59653/jemls.v2i02.650>
- Quraishi, T., ULUSI, H., MUHID, A., HAKIMI, M., & OLUSI, M. R. (2024). Empowering students through digital literacy: A case study of successful integration in a higher education curriculum. *JOURNAL OF DIGITAL LEARNING AND DISTANCE EDUCATION*, 2(8), 667-681. <https://doi.org/10.56778/jdlde.v2i8.208>
- Rahman, M. W., Hasan, M. M., Palash, M. S., & Asaduzzaman, M. (2024). Medical education in Bangladesh from Student and Teacher's Perspective: Impact and challenges of the COVID-19 pandemic. *MedEdPublish*, 13(209), 209. <https://mededpublish.org/articles/13-209/v2>
- Rahman, M. W., Hasan, M. M., Palash, M. S., & Asaduzzaman, M. (2024). Medical education in Bangladesh from Student and Teacher's Perspective: Impact and challenges of the COVID-19 pandemic. *MedEdPublish*, 13(209), 209. <https://mededpublish.org/articles/13-209/v1>
- Ruiz, J. G., Mintzer, M. J., & Leipzig, R. M. (2006). The impact of e-learning in medical education. *Academic medicine*, 81(3), 207-212. <https://doi.org/10.1001/jama.2011.1234>
- Shabila, N. P., Alkhateeb, N. E., Dauod, A. S., & Al-Dabbagh, A. (2021). Exploring the perspectives of medical students on the application of e-learning in medical education during the COVID-19 pandemic. *Work*, 70(3), 751-762. <https://content.iospress.com/articles/work/wor205339>
- Singh, H., & Miah, S. J. (2020). Smart education literature: A theoretical analysis. *Education and Information Technologies*, 25(4), 3299-3328. <https://link.springer.com/article/10.1007/s10639-020-10116-4>
- Wang, J. (2024). Improvement of Student Interaction Analysis in Online Education Platforms through Interactive Mobile Technology and Machine Learning Integration. *International Journal of Interactive Mobile Technologies*, 18(9). <https://doi.org/10.3991/ijim.v18i09.49291>
- Zhang, W., Cai, M., Lee, H. J., Evans, R., Zhu, C., & Ming, C. (2024). AI in Medical Education: Global situation, effects and challenges. *Education and Information Technologies*, 29(4), 4611-4633. <https://link.springer.com/article/10.1007/s10639-023-12009-8#Abs1>